Chapter 5 Problems

1. What wavelength does the 'IR ledge'for vegetation occur at? Is this in the bandwidth
    of a silicon detector?

                    0.7 µ;   yes

2. When was the first Landsat launched?
    http://ltpwww.gsfc.nasa.gov/LANDSAT/CAMPAIGN_DOCS/PROJECT/Comparison.html

Summary of Landsat Missions and Sensors

Satellite	Launch Date	Sensors	Status
Landsat 1	7-23-72	MSS	Expired 1-6-78
Landsat 2	1-22-75	MSS	Expired 2-5-82
Landsat 3	3-5-78	MSS	Expired 3-31-83
Landsat 4	7-16-82	MSS, TM	Sensors ceased operation 7-87;
Landsat 5	3-1-85	MSS, TM	Operational
Landsat 6	10-93	MSS, ETM	Lost at launch
Landsat 7	4-15-99	ETM+	Operational

3. How many spectral channels are used for the Thematic Mapper instrument? Over
    what wavelength ranges? 7 – 6 reflective, 1 thermal
                    Wavelength ranges: VNIR (0.4-1.0µ), SWIR(1-2 µ),   LWIR (10 µ)

4. How wide is a standard Landsat 7 image? What is the spatial resolution for the 6
    reflective bands? What is the spatial resolution for the thermal band? How many
    pixels wide (samples) does this make an image in the reflective band?
    http://ltpwww.gsfc.nasa.gov/IAS/handbook/handbook_htmls/chapter6/chapter6.html

A standard WRS scene covers a land area approximately 185 kilomenters (across-track) by 180
kilometers (along-track). A more precise estimate for actual scene size can be calculated from the
0R product image dimensions. These are listed in table 6.1

Table 6.1 Image Dimensions for a Landsat 7 0R Product

Band Number	Resolution (meters)	Samples (columns)	Data Lines (rows)	Bits per Sample
1-5, 7	30	6,600	6000	8
6	60	3,300	3,000	8
8	15	13,200	12,000	8

It is natural to assume that one could determine a scene's spatial extent by multiplying the rows
and columns of a scene by the IFOV. This would lead to a scene width of 198 kilometers (6600
samples * 30 meters) and a scene length of 180 kilometers (6000 lines * 30 meters). While this
calculation applies to scene length, the scene width calculation is more complicated due to the
presence of image buffers and the staggered image bands in the 0R product. Left and right image
buffers were placed in the 0R product to accommodate a possible increase in scan line length
over the mission's life. ……………
The nominal width for a scene is therefore 182.61 kilometers (6087 * 30 meters).
The ETM+ will produce approximately 3.8 gigabits of data for each scene,
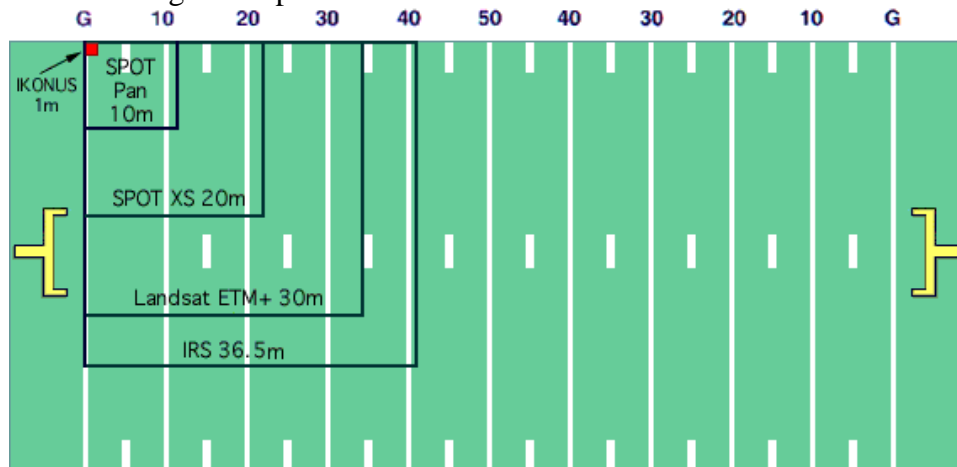
5. How does SPOT differ from Landsat 7?
    Spatial resolution (spectral bands, high-resolution panchromatic band)
    Wavelength for high-resolution panchromatic band – see text
   Orbit
   Wavelengths of spectral bands – see text

6. What is the nominal orbit for Landsat 7? (altitude, inclination, local time for equator crossing)

The orbit of Landsat 7 is repetitive, circular, Sun-synchronous, and near polar at a nominal altitude of 705 km (438 miles) at the Equator. The spacecraft crosses the Equator from north to south on a descending orbital at 10:00 AM on each pass. Each orbit takes nearly 99 minutes, and the spacecraft completes just over 14 orbits per day, covering the entire Earth between 81 degrees north and south latitude every 16 days.
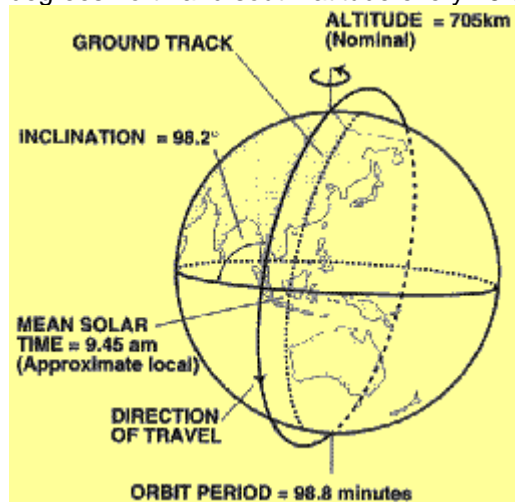
7. How long is the repeat cycle for Landsat 7?

Repeat imaging opportunities for a given scene occur every 16 days (see Chapter 5 for details). This does not mean every scene is collected every 16 days. Duty cycle constraints, limited onboard recorder storage, the use of cloud cover predictions, and adherence to the Long Term Acquisition Plan make this impossible. The goal, however, is to collect as much imagery as possible over dynamically changing landscapes. Deserts do not qualify and thus are imaged once or twice per year. Temperate forests and agricultural regions qualify as dynamic and are imaged more frequently. Figure 6.7 illustrates archived imagery during the mission's first 112 days. Although the mission is still young, certain trends are emerging. The U.S including Alaska is quite green because every imaging opportunity is exploited. North Africa is mostly desert and appears red. Northern Asia is mostly red and yellow due to recorder constraints.

Number of times each Path/Row is represented in the Landsat 7 archive.

1   2   3   4   5   6   7
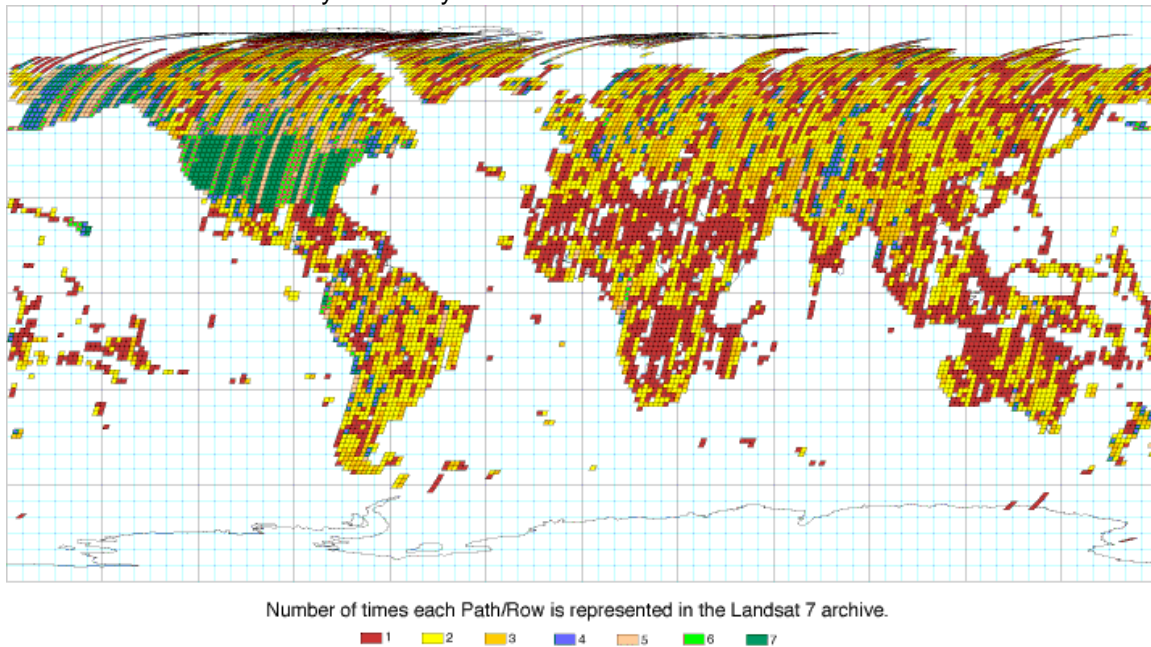
8. What is the dynamic range for the visible detectors on Landsat 7 (6, 8, or 10 bits)? (you may need to go to the NASA/GSFC Landsat site on the WWW)

see answer to question 4

9. What is the nominal spectral resolution for AVIRIS (compare to Landsat).
http://makalu.jpl.nasa.gov/html/aviris.overview.html
http://makalu.jpl.nasa.gov/html/aviris.instrument.html